Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 2 and 25 of the	)	ET Docket No. 98-206
Commission's Rules to Permit Operation	)	RM-9147
of NGSO FSS Systems Co-Frequency with	)	RM-9245
GSO and Terrestrial Systems in the Ku-	)	
Band Frequency Range	)	
and	)	
Amendment of the Commission's Rules	)	
to Authorize Subsidiary Terrestrial Use	)	
of the 12.2-12.7 GHz Band by Direct	)	
Broadcast Satellite Licensees and Their	)	
Affiliates	)	

ORIGINAL

REPLY COMMENTS OF PANAMSAT CORPORATION

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SUMMARY

PanAmSat's filing replies to the comments that have been filed in this proceeding. There is general agreement among the parties that the Commission should not adopt the epfd and apfd limits that were adopted provisionally at WRC-'97. There is also a consensus view among the parties that it would be premature for the Commission to adopt final, binding epfd and apfd limits at this stage.

Given these circumstances, PanAmSat urges the Commission to await the outcome of the outcome of the Working Part 4A meeting later this month and the JTG 4-9-11 meeting in May, at which time the Commission should move quickly to develop U.S. technical standards for NGSO systems. In developing U.S. sharing standards, the Commission should take the JTG's studies and conclusions into account. Unless consensus is achieved, however, the Commission should not simply adopt the JTG's final recommendations. Rather, it should examine the record compiled by the JTG and adopt technical rules that reflect the special requirements presented by the United States' unique and extensive existing use of the Ku-band.[1]

As to particular technical issues:

- There is insufficient information to determine the number of NGSO systems that are likely to be launched and placed into service, and further study is warranted.

- The Commission should not permit the NGSO proponents to forsake their initial commitment to avoid noticeable degradation to GSO systems.

- "Excess" link margin is a resource that GSO operators created, paid for, and should be entitled to rely on.

- NGSO epfd and apfd limits should protect the full range of GSO operations, including sensitive links.

- Requiring GSO systems to allocate additional power to overcome NGSO interference would cause overall GSO system capacity to decline.

- A variety of factors create a substantial risk that GSO systems will be underprotected, including a lack of real world demonstrations of NGSO systems;

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[1] NPRM at ¶ 11; see also Hughes Comments at 2; Boeing Comments at 9; GE Americom Comments at 6, 8; Satellite Coalition Comments at 5-6.

uncertainty as to the correct value of "N"; a methodology D software program that deviates from the methods used by operators to calculate their link performance; overly optimistic assumptions concerning the performance requirements that GSO users can accept; refusal by NGSO proponents to provide complete data concerning their systems; use of envelope antenna patterns that deviate from normal ITU practice; ignoring some carriers, and avoiding full consideration of sensitive carriers; and NGSO attempts to exploit "excess" margin.

- Inclined orbit GSO space stations deserve protection from NGSO interference.

- GSO systems should have equitable access to the "NG104" bands.

- The Commission should seek additional information regarding the usage and protection requirements for large aperture earth stations.

- The Commission should protect vital GSO communications on TT&C frequencies by prohibit NGSO operations on this limited portion of the Ku-band.

- The Commission should defer resolution of the arc avoidance issue pending further study.

- The Commission should not permit mobile operations in the Ku-band.

- To protect GSO operations, the Commission should augment software validation techniques with a procedure for validating actual hardware performance and a long-term means of assessing continued NGSO compliance with the final epfd and apfd limits.

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REPLY COMMENTS OF PANAMSAT CORPORATION

PanAmSat Corporation ("PanAmSat"), by its attorneys, hereby responds to the comments submitted in the above-referenced rulemaking.

I. THE COMMISSION SHOULD NOT ADOPT THE WRC-97 PROVISIONAL LIMITS — OR ANY OTHER TECHNICAL LIMITS — AT THIS TIME.

A. EPFD AND $EPFD_{UP}$ LIMITS.

The comments reflect broad consensus on two essential points. First, the Commission should not adopt the WRC-97 provisional epfd and apfd limits.[1] GSO system operators, NGSO proponents, and GSO customers all agree that these limits are inadequate and outdated and should not be enshrined in the Commission's rules.

Second, the commenters agree that it would be premature for the Commission to adopt final, binding limits at this stage of the ITU study process.[2] The ITU technical

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[1] E.g., Echostar Comments at 3-4, 5; Telesat Canada Comments at 5; Hughes Comments at 2; HBO/TBS Comments at 4-5; SkyBridge Comments at 33-35, 118; Denali Comments at 8; Virtual Geosatellite Comments at 7, 9-10; GE Americom Comments at 5, 7, 18-20; Satellite Coalition Comments at 2, 3-5.

[2] E.g., Echostar Comments at 4; Qualcomm Comments at 2-3; Telesat Canada Comments at 3; Boeing Comments at n.10; HBO/TBS Comments at 5; Loral Comments at 2-4; SkyBridge Comments at 118; Denali Comments at 9; GE Americom Comments at 8-9.

body charged with studying GSO/NGSO sharing, JTG 4-9-11, has developed an extensive record and has made a great deal of progress in defining the risks posed by NGSO use of GSO spectrum. Parties participating in JTG 4-9-11 are making every effort to achieve consensus epfd and $epfd_{up}$ limits; if they do, those consensus limits will merit substantial deference by the Commission. Even if consensus is not achieved, the JTG's conclusions and underlying analyses will deserve the Commission's careful consideration.

PanAmSat continues to believe that the methodology used in the United States submission to JTG-4-9-11 at Long Beach is the appropriate one for determining final technical limits.[3] Notwithstanding this belief, PanAmSat concurs with other parties that the Commission should wait for the results of JTG 4-9-11's final meeting in May of this year before it proceeds to adopt technical limits.[4]

Waiting for the JTG 4-9-11 results will promote the public interest by giving the JTG an opportunity to complete its work and seek consensus. In addition, it will make it possible for interested parties to study the technical and legal ramifications of several relatively new sharing proposals.

For example, Boeing has proposed that NGSO interference limits be based upon the level of degradation to a GSO FSS signal, viewed as the decrease in the network's C/N, rather than on the WRC-97 10% standard[5]; Boeing also has proposed that it might be preferable to employ two separate NGSO emissions masks, one to address short-term interference and the other to address long-term interference, or to permit each NGSO system to develop individualized limits that reflect the system's design and expected performance[6]; and several parties have proposed that epfd and $epfd_{up}$ limits should be stated as masks rather than as discrete limits.[7] While each of these approaches has technical appeal and merits further study, none has been

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[3] See also Hughes Comments at 2-3; Echostar Comments at 5; GE Americom Comments at 10, 14-15.

[4] None of the limits proposed in comments reflect consensus among interested parties or have been endorsed by the JTG. Denali's proposed limits, for example, are single-entry limits that, if converted to reflect the reality of multiple entry, fall short of those that were proposed by the United States at Long Beach. See Denali Comments at 9.

[5] Boeing Comments at 4, 18-20.

[6] Boeing Comments at 13-15.

[7] E.g., Loral Comments at 3, SkyBridge Comments at 32.

reviewed sufficiently to determine whether it should be adopted. Moreover, it is not clear whether Boeing's proposal regarding the use of C/N can be implemented in light of the constraints imposed by Resolution 1323.[8] Additional time will make it possible for interested parties to study the legal and technical implications of each of these alternative approaches and, perhaps, use one or more of them to reach consensus.

A brief delay also will serve the goal of successful sharing by giving NGSO proponents additional time to study ways in which design modifications could reduce the potential for interference and/or the costs of interference mitigation strategies. Importantly, some of the more recently designed systems (such as those proposed by Hughes and Boeing) meet interference protection limits that are acceptable, or very nearly acceptable, to the GSO community. In contrast, the design of SkyBridge's system — including its use of "sticky beams" and its orbital characteristics and traffic management scheme — present unique sharing problems and threaten GSO networks with serious short-term interference problems, including losses of synchronization.[9]

On some issues, JTG 4-9-11 already has reached preliminary conclusions that can be credited by the Commission. For example, there is now broad agreement that the interference threshold for NGSO uplink transmissions should be defined in terms of $epfd_{up}$, rather than apfd.[10] The Commission should allow its analysis of GSO/NGSO sharing to evolve in lights of these advances. On the core issue of setting epfd and $epfd_{up}$ limits, however, the Commission should not act precipitously.[11] As

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[8] Resolution 1323 dictates that final epfd and apfd limits be based upon certain specified criteria, including the 10% criteria.

[9] In PanAmSat's experience, sync losses of any duration — even "minor" losses of one or two seconds — cause problems for end users and result in large numbers of complaints to carriers. In some cases, losses of synchronization may result in network outages that are substantially longer than the sync loss itself, or have other serious consequences for overall network performance. See Boeing Comments at 16-17 (discussing problems caused by short-term interference).

[10] E.g., Boeing Comments at 36-37; SkyBridge Comments at 44; Sullivan Comments at 4-5.

[11] Some comments claimed that there is consensus on the required $epfd_{up}$ level and that the Commission, therefore, could proceed immediately to adopt an $epfd_{up}$ level. E.g. Boeing Comments at 34. This claim, however, is incorrect: although there is not sharp disagreement on the appropriate $epfd_{up}$ level, there is not yet consensus on a final limit. See, e.g., Telesat Canada Comments at 4. For the reasons stated herein, therefore, the Commission should defer action on both the epfd and the $epfd_{up}$ levels.

even SkyBridge acknowledges, the importance of setting appropriate limits and of basing those limits on the best available technical evidence clearly justifies a brief delay in the Commission's rulemaking effort.

B. MULTIPLE ENTRY ASSUMPTIONS.

The comments also make clear that, at this time, there is insufficient information upon which the Commission can determine the number of NGSO systems that are likely to be launched and placed into service.[12] PanAmSat concurs with JTG 4-9-11's conclusion that "N" likely lies between 3 and 5. The Commission should reject the self-serving effort by some NGSO proponents to define "N" as three, which may serve their private interests but at the expense of the public interest.[13] Three is the lower end of the agreed range and, thus, the use of N=3 results in the most generous allocation of interference "rights" for an NGSO system. If N turns out to be larger than three, any Commission allocation of aggregate interference limits based upon an assumption that N=3 could have catastrophic consequences for GSO operations.[14]

Deferring this issue temporarily is likely to bring about a substantial increase in the certainty with which "N" can be defined. Domestically, the Commission can proceed, on a preliminary basis, to process the first-round NGSO applications and refine its understanding of how many qualified applicants it likely will face. Internationally, as Boeing noted, the ITU now enforces a five-year due diligence milestone requirement and, as a result, by the time of WRC-2000 it should be much

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[12] E.g. Echostar Comments at 7; Boeing Comments at 5.

[13] See, e.g., SkyBridge Comments at 28, 29 (although SkyBridge admits that there is no agreement on the appropriate value for "N", it urges the Commission to use N=3).

[14] See Boeing Comments at 52. If the Commission proceeds to define single-system limits before it is clear what the correct value for "N" is, it should select the highest reasonable value for "N" (currently, five). E.g. DirecTV Comments at 19. In addition, it should make clear that all licensed NGSO systems will be responsible collectively for complying with the aggregate interference limits and that, if "N" turns out to be larger than predicted, or if additional second-round systems are authorized, each system's individualized limits will be adjusted downward as necessary. See GE Americom Comments at 10, 12. See also Satellite Coalition Comments at 5. Indeed, there is agreement among the JTG participants that WRC-2000 should adopt a resolution requiring NGSO systems to coordinate among themselves to permit additional entry, while ensuring that the aggregate interference masks continue to be met.

clearer which non-U.S. systems are "real" and which are not.[15] Moreover, on a technical level, the JTG will continue to study the question of multiple entry and, by the time it concludes its work, should have a better understanding of how many NGSO systems can be operated within the available spectrum.

II. THE COMMISSION SHOULD SUPPORT CONTINUED EFFORTS TO DEVELOP SUITABLE EPFD AND $EPFD_{UP}$ LIMITS.

The Commission has a positive role to play in the final stages of the JTG process. Between now and the JTG's final meeting in May, the Commission can improve the chances for reaching consensus by making clear to all interested parties the policy objectives and technical framework that ultimately will guide it in adopting U.S. standards. In this manner, the Commission can help to eliminate unnecessary disputes and ensure that the questions being considered by the JTG are framed properly. In addition, it can set the stage for prompt action once the JTG completes its work.

Both in their comments in this proceeding and in their submissions to JTG 4-9-11, some of the NGSO proponents proceed from three fundamentally incorrect premises. First, they seek to place too heavy a sharing burden on the long-standing users of the bands they now wish to enter. Second, they fail to comprehend (or, perhaps, are unwilling to acknowledge) the reality within which GSO systems operate. As a result, they underestimate the burdens they are imposing on GSO operations. Finally, they overstate the protective effects of a limited number of conservative assumptions used in GSO/NGSO interference studies. In each of these areas, PanAmSat urges the Commission to make clear to NGSO proponents the errors underlying their analysis.

A. NGSO PROPONENTS MUST ACCEPT THEIR OBLIGATION TO ENSURE THAT THEIR OPERATIONS DO NOT CAUSE HARMFUL INTERFERENCE TO EXISTING OR FUTURE GSO OPERATIONS.

When SkyBridge first sought access to GSO spectrum, it promised that NGSO operations: (i) would cause no noticeable degradation to the quality of service or availability of GSO satellite operations and (ii) would impose no operational constraints on GSO satellite operations.[16] Similarly, when the Commission issued its

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[15] Boeing Comments at 64.

[16] NPRM at ¶ 2 (citing SkyBridge Petition, RM-9147).

NPRM in this proceeding, it made clear its intent to adopt technical criteria that "ensure that ...NGSO FSS operations do not cause unacceptable interference to existing users [and] do not unduly constrain future growth of incumbent services."[17]

Now, however, SkyBridge has changed its story, stating that it expects GSO operators to accept "some degree of burden sharing."[18] While it continues to give lip service to protecting GSO services, it clearly hopes that the Commission will force GSO operators to bear quite a bit of the sharing burden in terms of services not offered, customers not served, technological advances not implemented, revenues lost, and risks accepted.

SkyBridge's about-face is particularly objectionable when one contrasts its position on NGSO/GSO sharing to its position on first-round NGSO/second-round NGSO sharing. With respect to GSOs, SkyBridge contends that NGSOs and GSOs are simply "two services" that have been "asked to share a frequency band."[19] Consequently, SkyBridge argues, it is appropriate that "some constraints are imposed on each side in order to make the sharing possible."[20] Reading this description, one would have no idea that SkyBridge is a newcomer seeking to use spectrum that has been used intensively by the GSO service for two decades.

In contrast, when discussing the appropriate relative positions of first- and second-round NGSO systems SkyBridge takes a hard line. In this context, SkyBridge claims that "[i]t is not technically or financially reasonable, or consistent with longstanding Commission policy, to ask a previously-licensed system, particularly one in operation, to materially alter its parameters to accommodate a later entrant."[21]

PanAmSat and the other GSO operators recognize that they must act reasonably to accommodate, to the extent possible, proposed NGSO operators. PanAmSat also recognizes that many of the NGSO applicants are attempting to

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17 NPRM at ¶ 1.

18 SkyBridge Comments at 42.

19 SkyBridge Comments at 42.

20 SkyBridge Comments at 42.

21 SkyBridge Comments at 86; see also Loral Comments at 15 (NGSO first-round licensees should not have "any responsibility" for accommodating operations of subsequent NGSO licensees); Teledesic Comments at 2-6 (seeking to impose a much higher burden on second-round NGSO licensees than NGSOs seek to impose on GSOs); Boeing Comments at 63-64.

shoulder their fair share of the sharing burden.[22] SkyBridge, however, continues to attempt to shift onto GSO operators an unfair, unprecedented, and inappropriate obligation to modify and constrain their operations in order to minimize SkyBridge's sharing burden.

In order to promote certainty and reasonable compromise, PanAmSat asks that the Commission reiterate the respective obligations of GSO operators and NGSO proponents. Specifically, GSO operators should act reasonably in defining their systems' technical requirements and in considering interference mitigation strategies. In addition, they should not seek to require NGSO operators to accept unreasonable burdens: if two equally sound solutions to a potential interference problem exist, a GSO operator should not insist on the more burdensome approach. GSO operators, however, should not have an obligation to accept material limitations on their current or future operations.

In contrast, NGSO operators are entitled to seek to sharing solutions that minimize their burdens. This right, however, does not alter their fundamental obligation to design and operate systems that do not cause objectionable interference to existing or future GSO operations. Having designed a system that presents very serious sharing difficulties without having authority to launch and operate the system, SkyBridge cannot now complain that sharing solutions are too difficult, too complex, or too costly for it to implement.

B. NGSO PROPONENTS SHOULD NOT BE ABLE TO AVOID THEIR SHARING OBLIGATIONS THROUGH TECHNICAL OR RHETORICAL "SLEIGHTS OF HAND."

SkyBridge and, to some extent, other NGSO applicants, attempt to shift an unwarranted portion of the sharing burden onto GSO systems not only by overstating the GSO service's legal obligation to accommodate a new entrant but also by mischaracterizing the manner in which GSO systems operate and, thereby, understating the burdens their operations will impose on GSO networks.

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[22] For example, Hughes has designed two systems that can operate within the standards proposed by the GSO community. Similarly, there remains only a very small "gap" between the standards proposed by GSO operators and the standards Boeing has said it can meet.

1. "Excess" Margin.

Satellite operators and end users often allocate more power to a link than the absolute minimum needed to close the link and meet the end user's performance objective.[23] This additional margin is often referred to as "excess" margin. However, that term — if read literally — is misleading.

"Excess" margin is not "excess" in any true sense of the word. In the real world, links always include excess margin. The additional margin is intentionally included for any of a variety of reasons: to make it possible to increase the number of carriers at a later date; to overcome link margin loss due to earth station pointing inaccuracies; to make it possible for the user, at a later date, to implement new bandwidth efficient modulations requiring lower bit error rates or higher power levels; or to ensure that the link continues to meet its performance objective as the satellite ages and its power level declines, to name a few. It is a resource that intentionally was created by, is paid for by, and hence belongs to, the operator of the link.[24]

In practice, "excess" margin can disappear or decline at any time. To use the above examples, if additional carriers are added, if earth stations are pointed inaccurately, if a new modulation is employed, or if network performance declines with age, "excess" margin will no longer be excess.

"Excess" link margin belongs to , and may be needed at any time by, the link's operator. Neither SkyBridge nor any other NGSO applicant should be allowed to take this resource away by insisting that it be used to overcome the effects of NGSO interference rather than reserved — and, ultimately, used — for the purpose for which it was created. Not only would such an outcome be an unfair transfer of property from the GSO user to the NGSO operator, it would alter the GSO/NGSO competitive environment in the NGSO's favor.

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[23] Margin that is included to deal with rain fade is not included in "excess" margin.

[24] Because a satellite operator must allocate additional power — a scarce resource — to create excess margin on a link, the charge for the link includes a fee attributable to the excess margin.

2. "Sensitive Links."

There is broad agreement that NGSO epfd and $epfd_{up}$ limits must protect the full range of GSO operations, including so-called "sensitive links."[25] In addition, the Commission expressly has stated, and NGSO applicants at least have given lip service to, the principle that NGSO technical standards must protect both existing and future GSO operations. Yet when it comes to the issue of "sensitive links," SkyBridge (and, to some extent, other NGSO applicants) are attempting to limit sharply the number and type of links that are considered and, thereby, reduce their sharing obligation.

SkyBridge, for example, argues that the Commission should not afford protection to existing and potential GSO users located outside a GSO satellite's main beam, in desert areas, or at high altitudes, or GSO users who have high availability requirements.[26] SkyBridge also urges the Commission to rely exclusively on the JTG "Annex 2" data on sensitive links to assess the necessary protection limits for these links.[27] SkyBridge's approach runs counter to real-world considerations, and would unfairly penalize GSO operators and their existing and prospective customers. The Commission should put these issues to rest, making clear that NGSOs must fully protect sensitive links.

First, relying solely on the ITU's existing data on sensitive links would limit artificially the links that are considered, thereby exposing existing and planned GSO operations to interference. The ITU data do not reflect the true scope of the "sensitive link" problem. Because there were problems with the initial spreadsheet contained in the ITU's Circular Letter CR92, some links submitted to the ITU may not necessarily represent the worst case in terms of their susceptibility to NGSO interference.[28]

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[25] As an initial matter, the term "sensitive links" — like the term "excess margin" — can be misleading. Despite what the name implies, it is not the case that sensitive links are particularly sensitive to NGSO interference, and thus require a higher level of protection, due to any failure or inadequacy on their part. Rather, on most links, NGSO systems seek to take advantage of rain margins to help solve the interference problems their systems create. On sensitive links, this margin does not exist and, therefore, cannot be exploited by the NGSO operators.

[26] SkyBridge Comments at 43; see also Boeing Comments at 11.

[27] SkyBridge Comments at 31.

[28] Telesat Canada Comments at 4.

In addition, the data submitted in response to ITU CR92 and CR116 are not representative of the global distribution of links and services that GSO systems provide today and could provide tomorrow. Using the ITU databases, for example, it is impossible to determine the number of each type of link that exists or may exist in the future because each entry in the CR116 and CR92 databases may be representative of a large number of deployed systems.

Second, there is no clear definition of what constitutes a sensitive link. Although progress was made on this issue at the last meeting of the JTG, most administrations have had difficulty knowing how to respond to request for sensitive link information. The CR92 links that were initially solicited and submitted before the last JTG meeting, therefore, appear to reflect significant misunderstandings by administrations as to what was required. For example, it appears that some administrations may have submitted links just to have them tested to see if they are sensitive. If this data is used, it will overstate the percent of sensitive links that are protected by any candidate epfd and $epfd_{up}$ limits. Hence, the number of links in the CR92 and CR116 that fail or pass the interference recommendation of ITU-R.1323 does not meaningfully indicate whether sensitive links are protected.

Third, the NGSOs should not be allowed to claim that NGSO-proposed epfd and $epfd_{up}$ limits protect all existing sensitive links. Telesat Canada, for example, included in its comments a list of representative GSO/FSS links for which the WRC-97 provisional epfd limits would cause unacceptable interference.[29]

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[29] Telesat Canada Comments at 5 and Annex A. In this regard, SkyBridge's assertion that PanAmSat failed to identify in the Document 342 study any existing links that would be adversely affected by the WRC-97 limits, SkyBridge Comments at 43, is grossly misleading. As SkyBridge is well aware, this was not the purpose of the Document 342 study. Moreover, there are several problems with the WRC-97 limits that make it impossible to assess in any meaningful way whether they adequately would protect an existing link: they do not consider the criteria of S.1323; they specify limits for only a small number of earth station sizes; and they are single-entry limits. Despite these problems, Table 5.1.1-5 on page 29 of Document JTG4-9-11/342 demonstrates that the WRC-97 limits likely will not protect existing CR92 links. (It is difficult to make a one-for-one comparison because the 3-meter earth station percent of time values in the table and the 3-meter earth station values given for the WRC-97 provisional limits are much less stringent than the S.1323 limits shown in the table. As a consequence, at least the two links shown in the table would have failed to meet the S.1323 ten percent criteria under the WRC-97 provisional limits.)

Most importantly, the NGSOs should not be allowed to preclude consideration of predicted sensitive links. Any analysis that considers only actual, existing sensitive links will understate the true sharing problem because it will ignore market trends in the GSO satellite industry. As a result, any set of interference limits that is based upon such a list will lack the protection needed for future GSO applications that are both foreseeable and in the public interest.

Areas that include a large number of potentially sensitive links — that is, areas having little rainfall, high altitude regions, and areas lying outside a GSO satellite's main beam — often are characterized by limited existing communications infrastructure but have the potential for substantial communications infrastructure development. For example, Africa, China, and Russia all contain large areas within which any GSO links that are established will be "sensitive links." In each of these regions, the communications growth potential is substantial. In addition, in each area it is of profound policy importance that the Commission not inhibit the ability of end-users to implement modern communications infrastructures.

If only actual, existing links are considered in determining the protection required by GSO systems, the interference analysis will ignore the needs of potential users throughout regions such as Russia, Africa, and China. As a result, it will increase the cost of serving these regions (by making necessary higher power allocations or more expensive earth station equipment) or even make it impossible to provide services they may desire (in cases where satellite power is limited). Such an outcome would undercut the Commission's objectives of protecting GSO growth opportunities, fostering the development of a global information infrastructure, and maintaining competitive neutrality.

Considering only actual, existing "sensitive links" also will expose new technologies that are now being implemented or will be implemented in the future to interference from NGSO systems. Because the trend in telecommunications is toward higher bandwidth requirements and more complex services, the ability of GSO systems to implement more bandwidth-efficient modulations is a necessary competitive condition.[30] Yet bandwidth-efficient modulations generally are less

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[30] Since satellite spectrum is limited, in order to offer higher data rates and more complicated services GSO operators generally will need to exploit more bandwidth-efficient modulations.

power efficient and, therefore, more sensitive to interference. If NGSO systems are designed based solely on current usage patterns and link margins, new GSO technologies will be left unprotected, making it difficult or even impossible for GSO operators to implement these new modulation techniques.

In order to address the considerations discussed in the above paragraphs, PanAmSat has forwarded to the ITU a list of 170 links that are based on realistic assumptions about existing and future GSO operations. Each link was determined with reference to an actual PanAmSat satellite operating at its existing orbital location and an actual point on earth served by a PanAmSat satellite. PanAmSat's list of links is the only list that overcomes the inherent limitations of basing GSO protection criteria solely on the needs of existing links.[31] Consideration of this set of links helps to illuminate the burdens that the GSO community is being asked to shoulder.

3. Power.

SkyBridge underestimates the burdens that would be imposed by forcing a GSO system to allocate additional power to overcome NGSO interference.[32] SkyBridge ignores the fact that power is a scarce commodity on a GSO satellite. Accordingly, devoting extra power to overcome NGSO interference will cause overall GSO system capacity to decline.

Notably, SkyBridge fully recognizes the importance of power in its own operations.[33] It should not be allowed to assume away the importance of this issue to GSO operators.

PanAmSat, for example, recently began offering 8PSK modulation and already has seen extensive customer demand for this modulation technology. 16QAM modulation, which is twice as efficient as 8PSK, is now being tested and PanAmSat anticipates that it will be offered in the reasonably near future. An even more efficient modulation approach, 64QAM, is widely used by terrestrial networks and is anticipated to be integrated into satellite networks.

[31] Given the variety of services that could exist at a single location, the number of GSO satellites, and the infinite number of possible locations, it would be a prohibitive task to define all possible sensitive links.

[32] E.g. SkyBridge Comments at 43.

[33] SkyBridge Comments at 39-41.

4. Design Costs Versus Operational Costs.

When assessing the relative burdens to be borne by NGSO and GSO systems, it is important to recognize that the sharing costs that NGSO systems will face are fundamentally different from the sharing costs that will be imposed on GSO systems. In order to meet the sharing criteria that are likely to be adopted, NGSO systems will have to modify their system designs so as to limit emissions in the direction of GSO satellites and earth stations. NGSO costs, therefore, are design costs.

In order to continue operating notwithstanding the interference that NGSO satellites will cause, on the other hand, GSO systems will have to modify their ongoing operations. In particular, they will have to allocate more power to some links in order to ensure that sufficient margin is available to overcome NGSO interference. Because satellite power is a limited resource, any requirement that forces GSO satellite operators to allocate more power to individual links necessarily will limit the number of links that can be supported on a satellite. Thus, NGSO costs are one-time design costs, but GSO costs will continue in perpetuity.

If GSO satellite operators were forced to increase performance by 3 dB to overcome NGSO interference, this could cause them to suffer up to a 50% permanent reduction in their capacity and, consequently, a very substantial reduction in their revenue flow.[34] In contrast, under the interference limits proposed by the United States at Long Beach, GSO operators would, on average, have to increase performance by 1 dB. This would result in a capacity reduction of 10% — still a very substantial price to ask GSO operators to pay, but far lower than the 50% figure that would result from SkyBridge's proposal.

Moreover, given that satellite design costs have been declining steadily and dramatically over the past decades, it is entirely reasonable to expect that NGSO design costs will experience a similar decline in the next several years. As a result, changes in NGSO system design likely will not cost as much, when they actually are paid for, as NGSO proponents today predict.

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[34] Each link in a satellite requiring a 3 dB increase in power to overcome NGSO interference would cause the satellite to lose the ability to implement an additional equivalent link or circuit. If a satellite had many sensitive carriers requiring an additional 3 dB of power to overcome NGSO interference, there could be an overall reduction in the satellite's capability approaching 50%.

5. The Global Information Infrastructure.

NGSO proponents also should not be allowed to immunize themselves from the need to protect GSO systems by wrapping themselves in a "Section 706" flag.[35] While NGSO systems may augment the global information infrastructure, GSO systems today are an integral and essential part of the global communications network, supporting a wide range of domestic and international telephony, data, and video communications, including high speed, interactive broadband services. PanAmSat, for example, provides high speed Internet access services on a global basis, including to remote regions in countries, such as India, with limited communications infrastructures. Similarly, DirecTV, through its "DirecPC" service, links users to information resources over the Internet. Thus, while the public interest may be served by adding NGSO offerings to the existing range of satellite and terrestrial options, this new service should not come at the expense of the wide range of services already provided by GSO systems.

C. REAL WORLD CONDITIONS MAY BE WORSE THAN THE NGSO PROPONENTS ASSUME.

SkyBridge takes the position in its comments that the assumptions underlying its sharing proposals are conservative — *i.e.*, in the face of uncertainty, some of its sharing assumptions use a "worst case" approach and, as a result, tend to protect GSO operations to the maximum degree reasonably believed necessary.[36] Any overprotective effect of those of its assumptions that might be considered conservative, however, is easily outweighed by other factors that create a very substantial risk that GSO operations will be underprotected. As a result, NGSO proponents should not be allowed to invoke the mantra of "conservative assumptions" to justify ignoring demonstrated inadequacies in their proposed sharing criteria.

1. The Uncertainty Inherent In NGSO Operations.

Most fundamentally, the effect of a small number of conservative assumptions is inconsequential when compared to the enormous uncertainty involved in the implementation of NGSO networks. NGSO systems are extraordinarily complex.

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[35] See SkyBridge Comments at 2-4.

[36] See SkyBridge Comments at 36-38; Sullivan Comments at 8.

Their ability to share spectrum with GSO systems relies on a host of technically and operationally difficult maneuvers, including arc avoidance, traffic allocation, diversity switching, NGSO/NGSO sharing, station keeping, and antenna tracking. If SkyBridge has its way, moreover, these systems will not be subject to any specific rules designed to protect GSO networks in the event of an NGSO satellite malfunction.[37]

Yet NGSO systems will be placed into operation without any real world demonstration of how they operate in practice. Indeed, if the NGSO applicants are allowed to keep design data proprietary, these systems will be deployed without even any meaningful external review of their performance capabilities. The "trust me" approach for implementing NGSO systems stands in sharp contrast to the manner in which GSO systems were implemented. In the case of GSOs, commercial deployment came only after intense public scrutiny and years of trials. Under these circumstances, it is unrealistic to expect NGSO systems to perform exactly as advertised.

2. Setting a Value for "N".

SkyBridge, among others, derives its proposed limits based upon the assumption that N=3. As discussed above, however, this reflects the most conservative estimate of the number of NGSO systems that will be placed into operation and, hence, tends to overstate the appropriate single-system interference limits.

3. Methodology D.

The use of Methodology D, as described in S.1323, to test the adequacy of proposed limits further skews the results of any interference analysis in the NGSOs' favor. The Methodology D software implementation that is currently used to test links is based on assumptions concerning link operation and link availability that deviate from the methods used by operators to calculate their link performance. The new effect of these differences is to underestimate link availability.

The Methodology D software treats any difference between an administration's specified availability and the predicted availability as additional margin. That additional margin makes the CR92 and CR116 links appear less sensitive than they actually are. It is apparent from the submitted CR92/116 link budgets and from

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[37] SkyBridge Comments at 55-56.

PanAmSat's discussions with other administrations' delegates that the significance of this fact has not been appreciated.

Moreover, the design processes for establishing link budgets is not standardized, and this fact introduces yet another bias into any analysis conducted using Methodology D. The JTG Methodology D software assumes certain design criteria when it evaluates a link. If the Methodology D assumptions differ from those that were used when designing the link, the link's objectives will not be taken fully into account during the evaluation phase. For example, if a link budget is designed with assumptions that differ from those in Methodology D, the JTG software may indicate that a link contains significant excess margin, even though — using the parameters determined by the satellite operator or end user — the link, in fact, contains no margin beyond that necessary to meet its availability requirement. In turn, the JTG software would use this presumed excess margin to demonstrate that the link is not sensitive to interference. In reality, however, the link would be left underprotected.

4. <u>Performance Requirements.</u>

In many cases, NGSO proponents adopt overly optimistic assumptions about the performance requirements that GSO users can accept. These assumptions ignore the fact that GSO systems are in direct competition with terrestrial services, which have a high performance capability. GSO satellite services, therefore, also must meet a very high performance requirement if they are to be competitive, and overly-optimistic assumptions about the number, severity, or duration of outages they can accommodate will have a detrimental impact on their viability and, more generally, on inter-modal competition.

Users of communications services generally are intolerant of even small outages (*e.g.*, on the order of seconds) or degradations in service. Satellite services already find it difficult to match the high availability performance of terrestrial systems due to the inherent cost and capacity/power constraints with which satellite systems must contend. Interference caused by NGSO systems will be an additional source of degradation and exacerbate this problem. In addition, unlike some forces of nature that may cause satellite network outages or degradations, such as solar flares or rain, NGSO interference is avoidable.

5. **Modeling Complexity.**

Generally, the ITU develops interference sharing limits based on conservative assumptions and estimates. This conservatism is viewed as a safety margin for existing systems. Additionally, interference evaluation procedures are usually developed to provide simple models that leave no room for misunderstanding on either side.

To the great concern of the GSO community, the epfd limits for NGSO systems are being developed under a veil of academic complexity and presumed accuracy which have not been justified. The GSO community argued for over a year that a simpler process of interference additions and comparisons would have provided a more tractable and understandable approach. The NGSO community, however, rejected these arguments and insisted on the more academic procedure.

6. **Information Sharing.**

The NGSO proponents' general refusal to provide complete data on their systems has made it impossible for GSO operators to verify the assumptions underlying their interference and performance claims.

For example, the NGSO community wants to be able to provide pfd masks developed through their own simulations. They appear not to want disclose sufficient information about their switching strategies and antenna designs in order for others to evaluate the proposed masks.

7. **Envelope Patterns.**

Instead of using the normal ITU practice of including envelope antenna patterns providing worst case results, the NGSO simulations use 50% envelope patterns for the GSO system and measured or analytic estimates for the NGSO pattern. Those approximations are anything but conservative, and add to the interference risk faced by GSO systems.

8. **Ignored Carriers.**

In its Comments and, more generally within the ITU process, SkyBridge ignores existing carriers in deriving its limits. For example, SkyBridge ignored carrier #45 because, it said, Procedure D is not sufficiently refined to deal with a carrier

elevation of 3°.[38] SkyBridge acknowledged that the inapplicability of Procedure D does not mean that a carrier should be ignored, but rather mandates that more detailed analysis be performed taking the carrier's unique characteristics into account.[39] Yet SkyBridge elected to ignore the carrier rather than perform the analysis.[40]

Similarly, SkyBridge ignored four sensitive carriers submitted by Canada.[41] SkyBridge did not contend that these carriers do not merit protection: its sole rationale for ignoring them was that, at some point in the process, the data describing the carriers had been fouled. Rather than contacting Canada to obtain the correct data, however, SkyBridge chose to act as though the carriers did not exist. This action is particularly objectionable in light of the fact that Canada provided — and SkyBridge examined without expressing any objection to — data on the carriers at the Long Beach JTG meeting. It also is of real consequence: at the January JTG 4-9-11 meeting in Long Beach, CA, Telesat Canada demonstrated that, using these carriers, in 5 out of 21 cases the WRC-97 provisional limits caused the 10% limit to be exceeded.

9. Sensitive Carriers.

As discussed in Section II(B)(2), *supra*, the NGSOs generally seek to avoid full consideration of sensitive carriers. Any limitation on sensitive carrier consideration may result in GSO capacity reductions and service constraints.

10. Excess Margin.

Finally, as discussed in Section II(B)(1), *supra*, the NGSOs' attempt to exploit "excess margin" to solve the interference problem they create further skews the results of any analysis in the NGSOs' favor.

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[38] SkyBridge Comments, Appendix A, at 3.

[39] Id.

[40] Similarly, PanAmSat serves a number of sensitive locations in the western United States that, by virtue of the fact that an elevation angle of less than 3° is involved, would not be deemed sensitive carriers using Procedure D.

[41] SkyBridge Comments, Appendix A, at 8.

III. ONCE JTG 4-9-11 COMPLETES ITS WORK, THE COMMISSION PROMPTLY SHOULD ADOPT U.S. TECHNICAL SHARING CRITERIA.

In May of this year, following the Working Party 4A meeting scheduled for later this month, JTG 4-9-11 will hold its final meeting and finalize its recommendations for the WRC-2000 Conference Preparatory Meeting ("CPM"). Once the JTG's May meeting closes, the Commission promptly should adopt sharing criteria and proceed with its processing of first-round NGSO applications.

By moving rapidly to adopt U.S. technical standards once the JTG concludes its work, the Commission will enhance its negotiating strength at the CPM and at WRC-2000, thereby promoting the interests of prospective U.S. NGSO licensees and improving the probability that whatever international standards ultimately are adopted adequately will protect U.S.-licensed GSO networks. Moreover, prompt action will help to ensure that NGSO networks can be deployed at the earliest reasonable time.

In developing U.S. sharing standards, the Commission should take the JTG's studies and conclusions into account. Unless consensus is achieved, however, the Commission should not simply adopt the JTG's final recommendations. Rather, it should examine the record compiled by the JTG and adopt technical rules that reflect the special requirements presented by the United States' unique and extensive existing use of the Ku-band.[42]

In addition, the Commission should apply the technical limits it adopts to protect GSO FSS operations to every band allocated for GSO FSS use in any ITU Region, even if a band is used domestically for a different or more limited service.[43]

IV. THE COMMISSION 'S OTHER TECHNICAL RULES GOVERNING NGSO OPERATIONS SHOULD BE EQUITABLE AND SUFFICIENT TO PROTECT EXISTING AND FUTURE GSO OPERATIONS.

A. INCLINED ORBIT

In its comments, PanAmSat urged the Commission to require NGSO systems to protect GSO FSS satellites operating in inclined orbits using a reasonable limit on

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[42] NPRM at ¶ 11; see also Hughes Comments at 2; Boeing Comments at 9; GE Americom Comments at 6, 8; Satellite Coalition Comments at 5-6.

[43] See PanAmSat Comments at 16-17.

inclination, to be determined on the basis of further evaluation. Three issues raised in the comments, however, merit response.

First, SkyBridge contends that arc avoidance will protect satellites in inclinations of up to 3° and that, as a result, no special requirements should be imposed to protect inclined orbit satellites.[44] PanAmSat agrees that the relevant standard for protecting inclined orbit satellites should be the epfd and $epfd_{up}$ levels established by the Commission: if an NGSO system can use arc avoidance to meet these levels with respect to an inclined orbit satellite, it will have fulfilled its obligation. However, it is premature to conclude that arc avoidance will, in fact, protect inclined orbit satellites adequately to the degree of inclination established by the Commission. If additional protection measures are required, NGSO licensees should be required to implement them.

Second, SkyBridge implies that inclined orbit satellites are not "true" primary spectrum users because, under the Commission's rules, they may not claim protection beyond that which would be required, or cause interference beyond that which would be caused, if they were operating in a fully station-kept orbit.[45] The rule cited by SkyBridge, however, merely reflects the fact that an inclined orbit GSO satellite will neither receive nor cause any greater level of interference from or to adjacent GSO satellites— and, hence, requires no greater degree of protection — than a fully station kept satellite. It in no way relegates inclined orbit satellites to second-class status. Moreover, under the ITU rules, a GSO FSS satellite is fully entitled to protection up to 5°.

Finally, Loral's comments provide a useful tool for assessing the harm caused to GSO operators by restricting the degree of usable inclination.[46] If one assumes that a GSO satellite starts with no inclination and drifts in the N-S direction at an average rate of 0.8° per year, then protecting GSO satellites at inclinations of up to 5° of inclination (*i.e.*, the maximum degree of inclination that is fully protected under the ITU's rules), a GSO operator would be able to use its satellite for 6.25 years of inclined orbit operations.[47] If GSO satellites are protected only up to 4° of inclination, the

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[44] SkyBridge Comments at 51-52.

[45] SkyBridge Comments at 51 (citing 47 C.F.R. § 47 C.F.R. § 25.280(b)).

[46] See Loral Comments at 6.

[47] GSO FSS satellites have, in fact, been operated at inclinations of up to 5°, and even higher degrees of inclination are possible. See Telesat Canada Comments at 7.

inclined orbit lifetime drops to 5 years (a 25% reduction in usable, revenue-generating life), and if they are protected only up to 3° of inclination, the inclined orbit lifetime drops to 3.75 years (a 67% reduction in usable, revenue-generating life). Even when considered in terms of the satellite's full useful life, the loss caused by a reduction from 5° to 3° is substantial: if one assumes a 15-year station kept lifetime, then protecting GSO satellites only up to 3° of inclination results in a reduction of 13% in the satellite's total life.

B. NG104 BANDS

The comments generally are consistent with the proposition that GSO interests should be treated equitably with respect to use of the 10.7-11.7 GHz and 12.75-13.25 GHz bands.[48] If given access to these bands, GSO operators could enhance their network productivity and the efficiency of future operations, while maximizing the use of scarce spectrum.[49] Moreover, terrestrial users acknowledge that GSO FSS/FS sharing is substantially easier to accomplish than is NGSO FSS/FS sharing.[50]

Accordingly, the Commission should authorize domestic GSO FSS use of the NG104 bands on a case-by-case basis, with a presumption in favor of licensing any earth station(s) that are limited in number and located outside any "exclusion area" adopted for NGSO gateways. In addition, it should license on a case-by-case basis any applications that do not meet these criteria but that otherwise are consistent with the policies underlying the rules giving NGSO FSS systems access to the NG104 bands for domestic communications.

C. LARGE APERTURE EARTH STATIONS

In its comments, PanAmSat urged the Commission to seek additional information regarding the usage and protection requirements for large aperture earth

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[48] Telesat Comments at 7; GE Americom Comments at 25; Satellite Coalition Comments at 6-7; see also Boeing Comments at n.27, 83-84.

[49] Loral Comments at 4, 8.

[50] FWCC Comments at 6, 16-17, 18. While the FWCC nonetheless opposes permitting GSO FSS systems to use the NG104 bands for domestic communications, FWCC Comments at 7, it fails to justify the inequitable treatment of GSO FSS systems.

stations and to design final rules only after this information has been collected and analyzed. Other comments support this approach.[51]

It should be noted, however, that SkyBridge's comments understate the extent to which large aperture earth stations need to be protected. According to SkyBridge, only DoD has raised concerns with respect to earth stations greater than 10 meters in diameter, and the DoD earth stations in question operate in the Ka-band.[52] PanAmSat, however, has submitted to the ITU data on approximately 30 antennas with diameters of more than 10 meters. Presumably, other U.S.-licensed GSO operators, as well as Intelsat, also have equivalent large antenna usage patterns.

In addition, SkyBridge implies that the term "large diameter earth stations" equates to earth stations of at least 18 meters in diameter.[53] In reality, the minimum diameter of earth stations requiring protection beyond the general epfd and $epfd_{up}$ limits will be far lower than 18 meters. It appears that any general epfd and $epfd_{up}$ that will be adopted will stop at 10 meters; as a result, study would have to begin at diameters of 10 meters to determine under what conditions coordination is needed to protect existing and future operations.

While the Commission need not adopt final rules at this stage governing the accommodation of large aperture antennas, it should clarify that NGSO operators bear the burden of solving interference problems through coordination. Successful coordinations involve a "give-and-take" between affected parties. However, as their system designs are finalized — and, particularly, once their systems are launched — NGSO licensees may have limited flexibility and, therefore, may have little to "give" in a coordination.

NGSO licensees should not be allowed to demand that operators of large aperture earth stations shoulder the burdens of solving the interference problem created by NGSO systems. In some cases, particularly when NGSO switching cannot reliably solve a problem, it may be rational to modify the GSO earth station operations rather than the NGSO satellite system operations. While implementation of the

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[51] E.g., Loral Comments at 5, 11; Satellite Coalition Comments at 6; see also Telesat Canada Comments at 7 (the introduction of NGSO FSS systems should not preclude future GSO FSS large aperture earth stations from being established).

[52] SkyBridge Comments at n.102.

[53] SkyBridge Comments at 47.

solution in these cases will shift to the earth station operator, however, the burden — including, where relevant, the financial burden — should remain with the NGSO licensee.[54]

D. TT&C

The comments — particularly those filed by the NGSO proponents — show inadequate appreciation for the critical and extraordinarily fragile nature of TT&C communications. Whether one is speaking of "routine" TT&C transmissions, transfer orbit transmissions, or emergency transmissions, any interference could cause the satellite to miss or misinterpret a command or cause ground controllers not to identify an anomaly in a timely manner. If this occurs, the results could be catastrophic. NGSO proponents, therefore, are demonstrably incorrect in claiming that short term interference will not harm TT&C functions and that the general epfd and $epfd_{up}$ limits are sufficient to protect most TT&C operations.[55]

Rather than attempting to develop different limits or specialized rules on NGSO systems in order to protect vital TT&C operations, the Commission should prohibit NGSO operations on GSO FSS TT&C frequencies. The importance of ensuring that all TT&C transmissions are secure is crucial, and the amount of spectrum at issue is inconsequential (for example, PanAmSat uses a total of only 5-7 MHz for TT&C for all of its satellites).

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[54] For example, if the problem can be solved by purchasing additional GSO satellite power for the link (if such power is available from the satellite operator), the NGSO licensee should fund the marginal cost associated with this change. Similarly, if the problem can be solved through the use of new antennas or modified earth station facilities, the NGSO licensee should finance these modifications. Such an approach would be consistent with the Commission's decision in ET Docket No. 92-9, for example, in which the Commission required emerging technologies licensees to pay the costs of relocating incumbent fixed service licensees.

[55] SkyBridge Comments at 53-54; see also Loral Comments at 7, Boeing Comments at 28. It also is interesting that SkyBridge is wary of using coordinations for large aperture earth stations because, it contends, GSO operators may use these coordinations to hold SkyBridge hostage, SkyBridge Comments at 50, but does not seem to recognize the parallel risk if GSO operators must rely on coordinations with NGSO operators to protect vital, time-sensitive TT&C operations.

E. ARC AVOIDANCE

In many cases, NGSO proponents have relied upon arc avoidance as the principal tool they will use to make sharing with GSO systems possible. In light of differences in NGSO system design, however, the Commission should not adopt a "single-number" GSO arc avoidance requirement. The necessary degree of arc avoidance depends on a variety of factors, including the NGSO system's orbit (MEO versus LEO), earth station antenna size, and link budget design. As a result, an overly simplistic approach could unfairly penalize some NGSO systems while underprotecting GSO systems in other cases. As with other technical issues, the Commission should defer resolution of this issue until after the JTG completes its work.

F. MOBILE SERVICES

In its comments, Boeing requests that the Commission permit NGSO FSS systems to provide ancillary mobile services.[56] The Commission should deny this request.

Typically, any attempt to add mobile services to spectrum allocated for fixed purposes creates an interference disaster. Only in relatively rare cases can sharing be accommodated; when it can, it is based upon careful study of the interference characteristics of the systems involved and, usually, upon strict technical rules to address the interference problem.

There has been no study of the interference effects that would be caused if NGSO FSS systems were allowed to provide mobile services. PanAmSat is skeptical that sharing between mobile NGSO operations and GSO FSS operations would be possible. In any event, mobile operations should not be authorized in the absence of careful study and appropriate technical rules.

V. THE COMMISSION SHOULD DEVELOP AND ENFORCE MEANINGFUL VERIFICATION REQUIREMENTS.

Most of the comments addressing the verification issue focused exclusively on the use of a software verification tool, ignoring the fundamental inadequacy of such a limited approach. If the Commission is to protect GSO operations, it must augment

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[56] Boeing Comments at 75.

software validation with two additional tools: a procedure for validating actual hardware performance and a long-term means of assessing continued NGSO compliance with the final epfd and $epfd_{up}$ limits.[57]

As discussed above, the launch of NGSO systems involves a leap of faith: if these systems do not perform as predicted, GSO operators and customers not only could lose the billions of dollars they have invested in their networks, but the underlying communications these networks support will be placed in jeopardy. Corporate data transmissions, Internet traffic, telephony traffic, video distribution, and a host of other applications will be at risk on a global basis.

Moreover, if NGSO interference occurs it will be difficult, if not impossible, for GSO operators and users to identify and cure the problem. As a legal matter, the Commission has proposed to define unacceptable interference solely with reference to the final technical standards: if an NGSO system meets the relevant limits, it will be deemed not to be causing objectionable interference. Thus, in order to have a valid interference claim, a GSO operator will need a means for determining whether an NGSO system is complying with the applicable limits. Compliance verification is difficult and expensive.

In addition, as a practical matter, interference often will occur sporadically. In most cases, it will difficult or impossible for GSO operators to identify the source of the interference from among the dozens or hundreds of terrestrial users and the dozens or hundreds of satellites in orbit.

Given the possibilities for errors in predicting NGSO performance, it would be risky in the extreme for the Commission to rely exclusively on computer modeling to "evaluate" the effect of NGSO transmissions on GSO operations. From the outset, such a limited approach would ignore the very significant risk that hardware will not, in fact, perform as designed. Post launch, it ignores the risks that aging satellite constellations, system malfunctions, the addition of new services and new modulations, the expansion of an initial system or substitution of second generation satellites, or other factors could alter system performance.

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[57] See Telesat Canada Comments at 6; DirecTV Comments at 22-23.

For the above reasons, the Commission should adopt rules that require not only software simulations but also system testing and in-orbit monitoring, in each case at the NGSO system's expense. In the first instance, the NGSO applicants should be allowed to develop a proposal on how to implement in-orbit monitoring: they have the most complete understanding of their systems and may be able to minimize the complexity and cost of this undertaking. The Commission should make clear to the NGSO applicants, however, that they must either develop a solution that meets the core requirements of reliability and transparency or face the imposition of a monitoring requirement designed by the Commission. In addition, the Commission should explicitly impose on NGSO licensees meaningful remedies to ensure that, if problems occur, the NGSO system will take whatever steps are necessary to cure them.

VI. SERVICE RULES

The comments confirm the harm that could be caused if unqualified or uncommitted entities are allowed to obtain and retain NGSO licenses without promptly placing a system into operation. Like PanAmSat, the commenting parties therefore urge the Commission to adopt strict financial qualification requirements, milestone requirements, and other service rules.[58]

CONCLUSION

This proceeding ultimately will allocate the burdens caused by NGSO entry: some will be borne by incumbent GSO operators, others by NGSO entrants. In allocating these burdens, the Commission will be dictating the outcome of crucial issues: Which parts of the GSO market will be protected, and which existing and future GSO customers will be exposed to interference? Which services will be possible in the future, and which not? What risks will cast a pall over the GSO industry, and what remedies will they have if NGSO systems cause greater problems than their proponents predict?

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[58] E.g. Boeing Comments at 6, 60-62, 65-73, SkyBridge Comments at 83, 105-107. Even if the Commission could avoid mutual exclusivity among first-round NGSO applicants, it still should adopt strict financial qualification and other requirements in light of the detrimental effect that "paper" NGSO systems could have on GSO operations.

PanAmSat accepts that its operations will be compromised, to some extent, by NGSO operations. It is likely that GSO operators will see their operations restricted in a number of areas, including their ability to serve existing and future sensitive links, to employ large aperture earth stations, and to operate satellites in inclined orbits. In addition, they will be forced to exist within a universe that is subject to substantially greater uncertainty and risk than historically has been the case. These burdens go far beyond those that have been imposed on other services in similar contexts and, indeed, go far beyond what the first-round NGSO applicants are willing to do to accommodate second-round NGSO systems.

In light of the risks and burdens being imposed on the GSO community, PanAmSat urges the Commission not to be drawn in by the glittering promises of the NGSO proponents. Only with a clear, unbiased view of the technical and market forces that are at issue will the Commission be able to design technical and service rules that are equitable and appropriately protective of GSO operators and end users.

Respectfully submitted,

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April 14, 1999

PanAmSat

ENGINEERING AFFIDAVIT

I, Philip A. Rubin, Chief Scientist of PanAmSat Corp., hereby certify that I am the technically qualified person responsible for the preparation of the technical information contained in these Reply Comments and that I am familiar with Part 25 of the Commission's Rules and Regulations. My experience is documented in many engineering filings with the Commission.

I have reviewed all technical materials provided herein and certify that they were either prepared by me or under my direction. I further certify that the technical information submitted in this amendment is complete and accurate to the best of my knowledge.

By: _____

Philip A. Rubin
Chief Scientist
PanAmSat Corp.

Date: 4/14/99

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